

Safety operation room

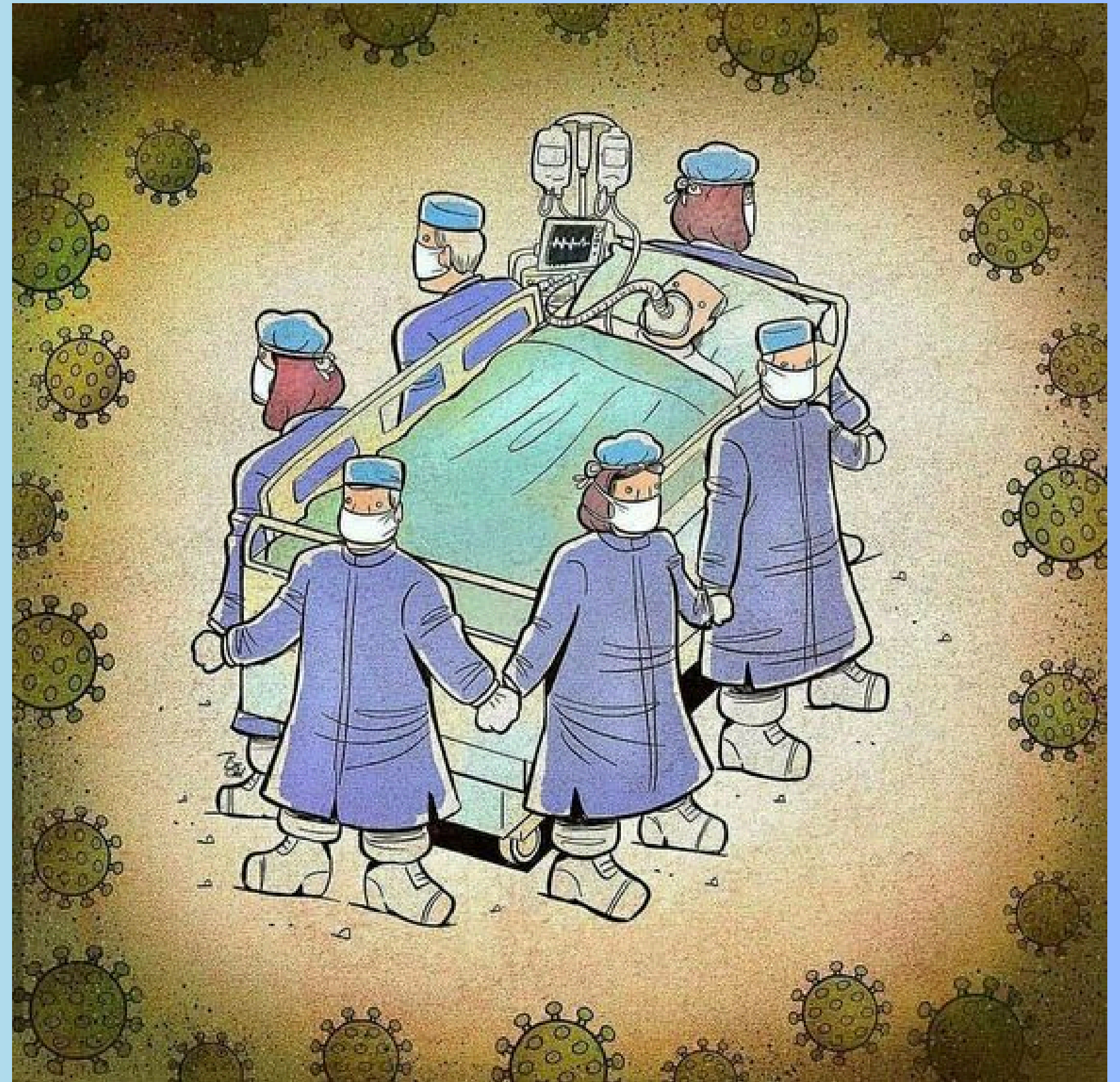
พญ. หัสญา ตันติพงศ์

อายุรแพทย์โรคติดเชื้อ

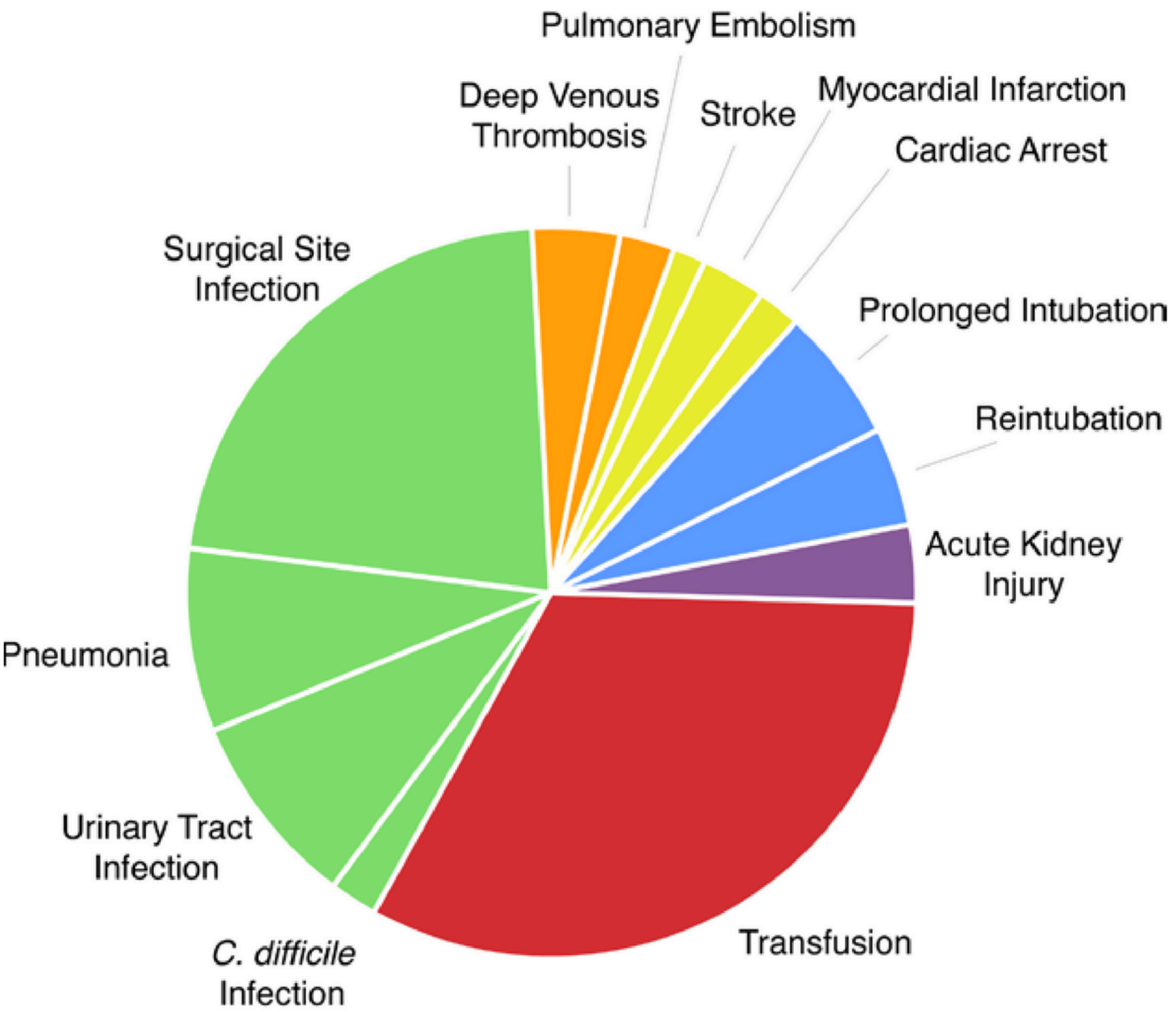
ประธานศูนย์ความเป็นเลิศด้านการควบคุมและป้องกันการติดเชื้อรพ.ชลบุรี

วัตถุประสงค์หลักของ “Safety
operation room”

**เพื่อให้ผู้ป่วยที่เข้ารับการผ่าตัด
ปลอดภัย ไม่เกิดภาวะแทรกซ้อน โดยเฉพาะการติดเชื้อจากการผ่าตัด (SSI)**

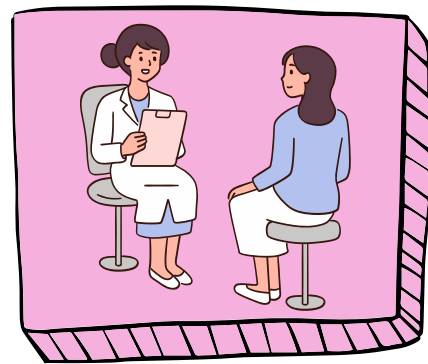


ภาวะแทรกซ้อน จากการผ่าตัด



Infection เป็นภาวะแทรกซ้อน
ที่พบบ่อยที่สุดหลังผ่าตัด และ
SSI เป็นสาเหตุที่สำคัญที่สุด

Timeline ที่เกี่ยวข้องกับ เกิด SSI



01. OPD

กร=บวนาการเตรียมผู้ป่วย
ขูดบุงรี
ควบคุมน้ำตาล
ควบคุมความดัน
ป้องกันการติดเชื้อ



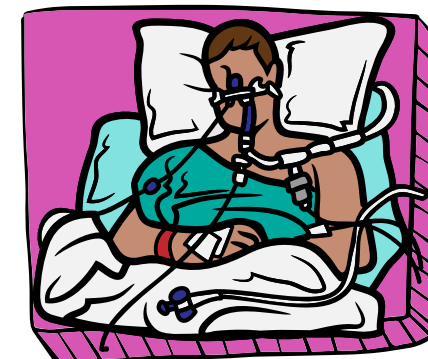
02. ward

เตรียมความพร้อมก่อนผ่าตัด
เตรียมทำความสะอาด=อาดบริเวณผ่าตัด
ใช้ clipping กำจัดขน / ผสม
ปร=ทาน OR เรื่องการฉีด ATB
ควบคุมระดับน้ำตาล



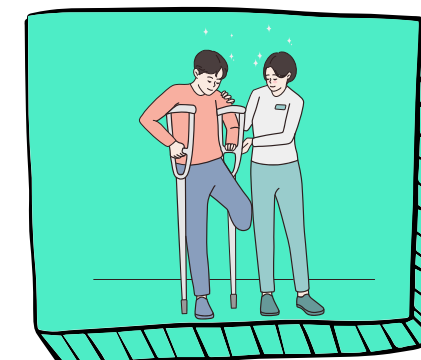
03. OR

กร=บวนาการใน
ห้องผ่าตัด



04. Ward

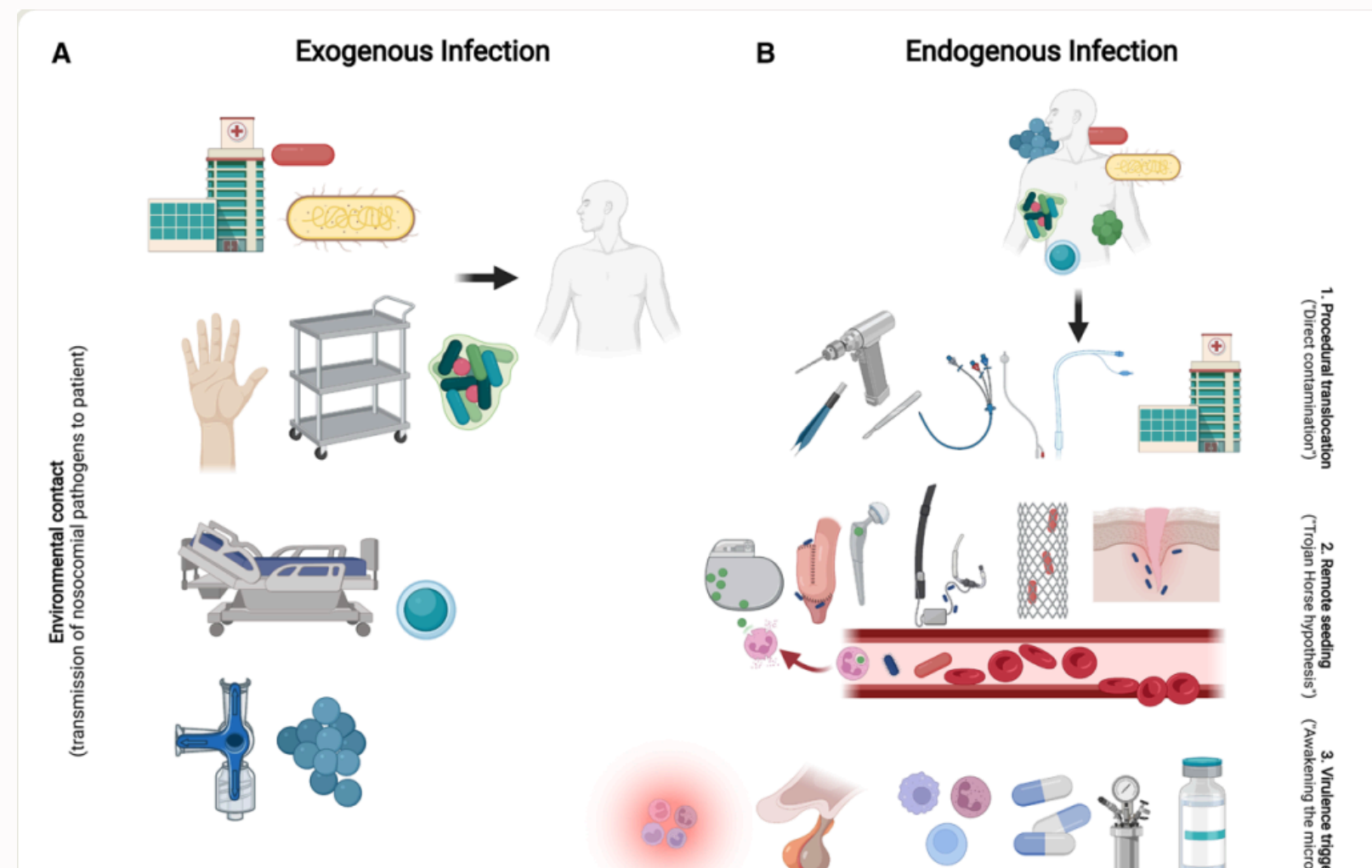
Prevention infection
bundle
&
clinical monitoring
&
Hand hygiene



05. Family

การดูแลที่บ้านตาม
หลักการป้องกันการ
ติดเชื้อ และภาวะ
แทรกซ้อนอื่นๆ

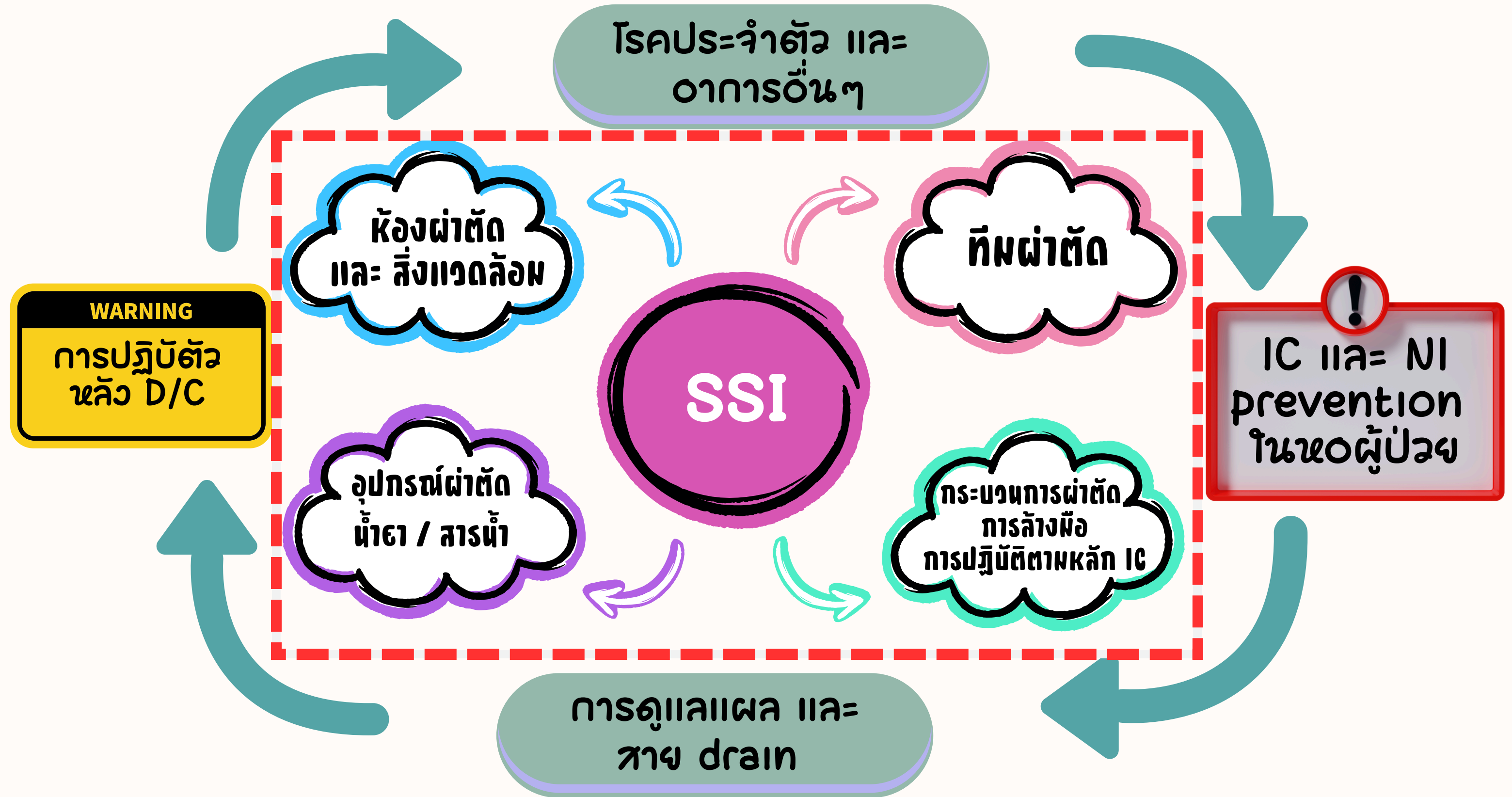
CSSD , งานผ้า และ งานทำความสะอาดพื้นที่



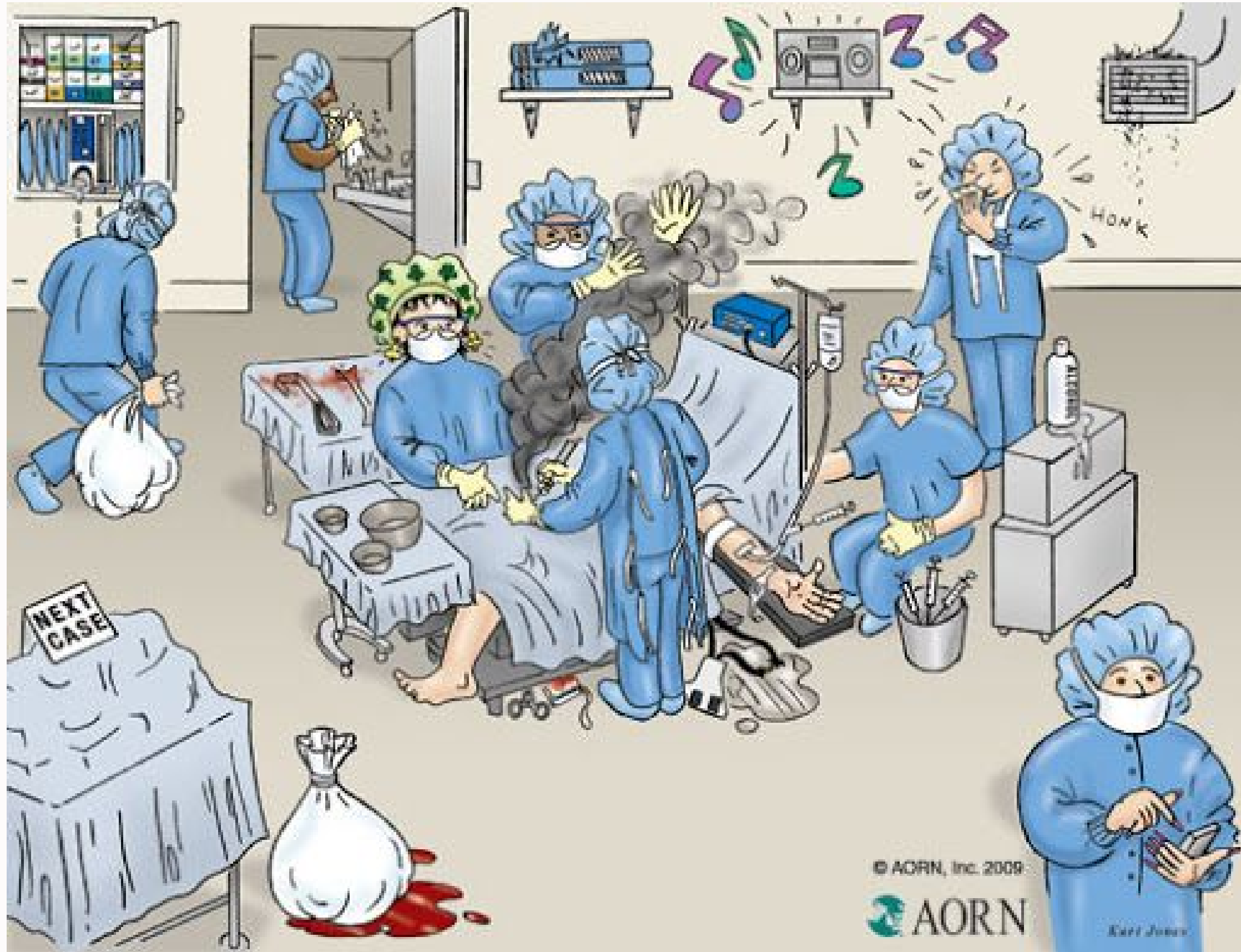
C Evolution of Surgical Site Infection Prevention Strategies by Route of Infection

	Exogenous	Both	Endogenous
Past	Focus on operating room attire	Increased FIO ₂ Avoidance of perioperative glucocorticoids Clean surgical instruments on closing	Mechanical bowel preparation Iodine-based skin antisepsis
Present	Targeted surface decontamination Sterile processing Ventilation/airflow Selective use of contact precautions	Hand hygiene Temperature management Glucose control Surgical antibiotic prophylaxis Sterile procedure IV system stewardship	Mechanical & antimicrobial bowel preparation Chlorhexidine-based skin antisepsis Preoperative methicillin-resistant <i>S. aureus</i> screening Nasal decolonization Reduced postoperative prophylaxis
Future	Broad surface decontamination? Single-use devices? Equipment covers? Universal contact precautions?	IV system filtration/sterilization systems? Microbiome-concordant medication selection? Closed incision negative pressure wound therapy? Far-ultraviolet-C light systems?	Antimicrobial-only bowel preparation? Individualized surgical antibiotic prophylaxis? Improved preoperative screening, decolonization? Dietary prehabilitation? Elimination of routine postoperative prophylaxis? Probiotics and/or fecal autotransplantation?

ห้องใช้การเกิด การติดเชื่อหลังการผ่าตัด



ห้องผ่าตัดของเราเป็นอย่างไร



เราอยากให้ห้องผ่าตัดของเราเป็นแบบไหน

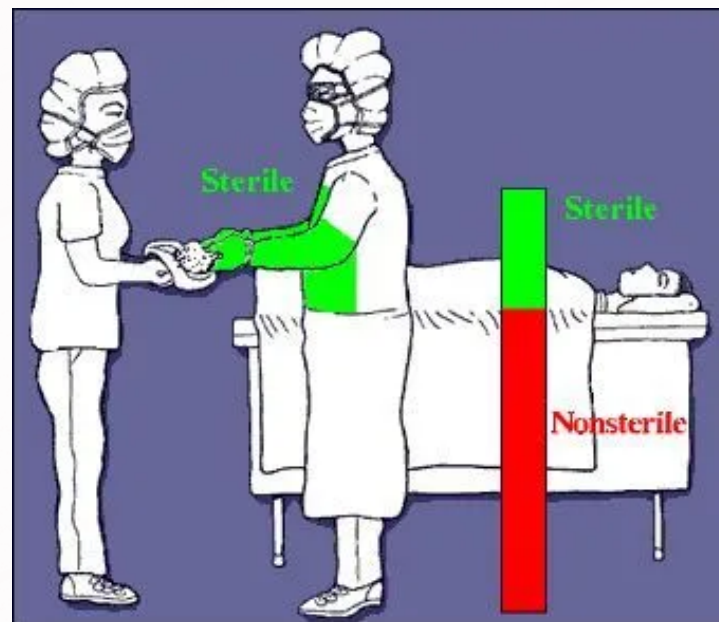


The Cornerstones of Infection Prevention (SSI)

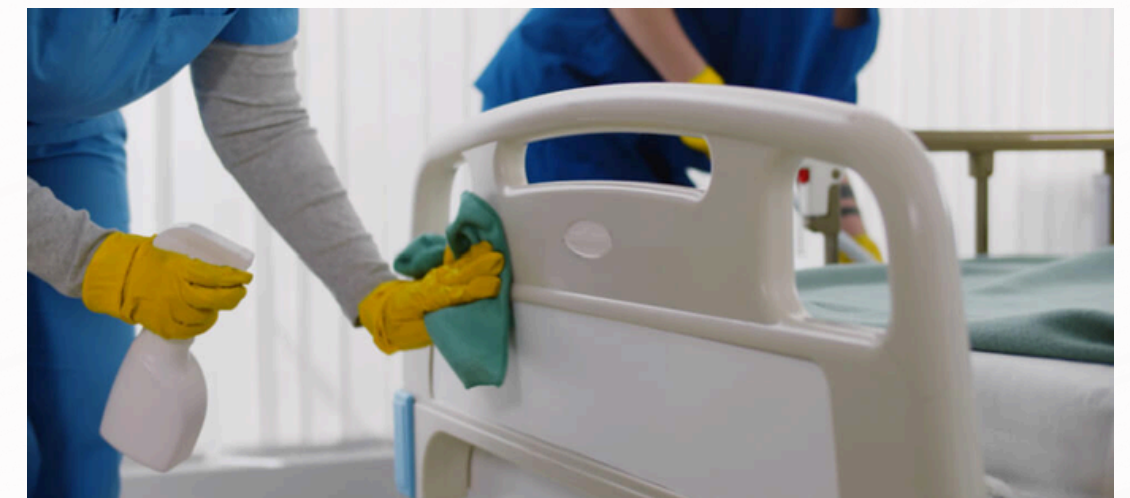
“prevent contamination & reduced bacterial load”



**Hand hygiene
and Surgical
attire**



**sterile
technique**



**cleaned perioperative
environment
surface/ ventilation/
thermal**

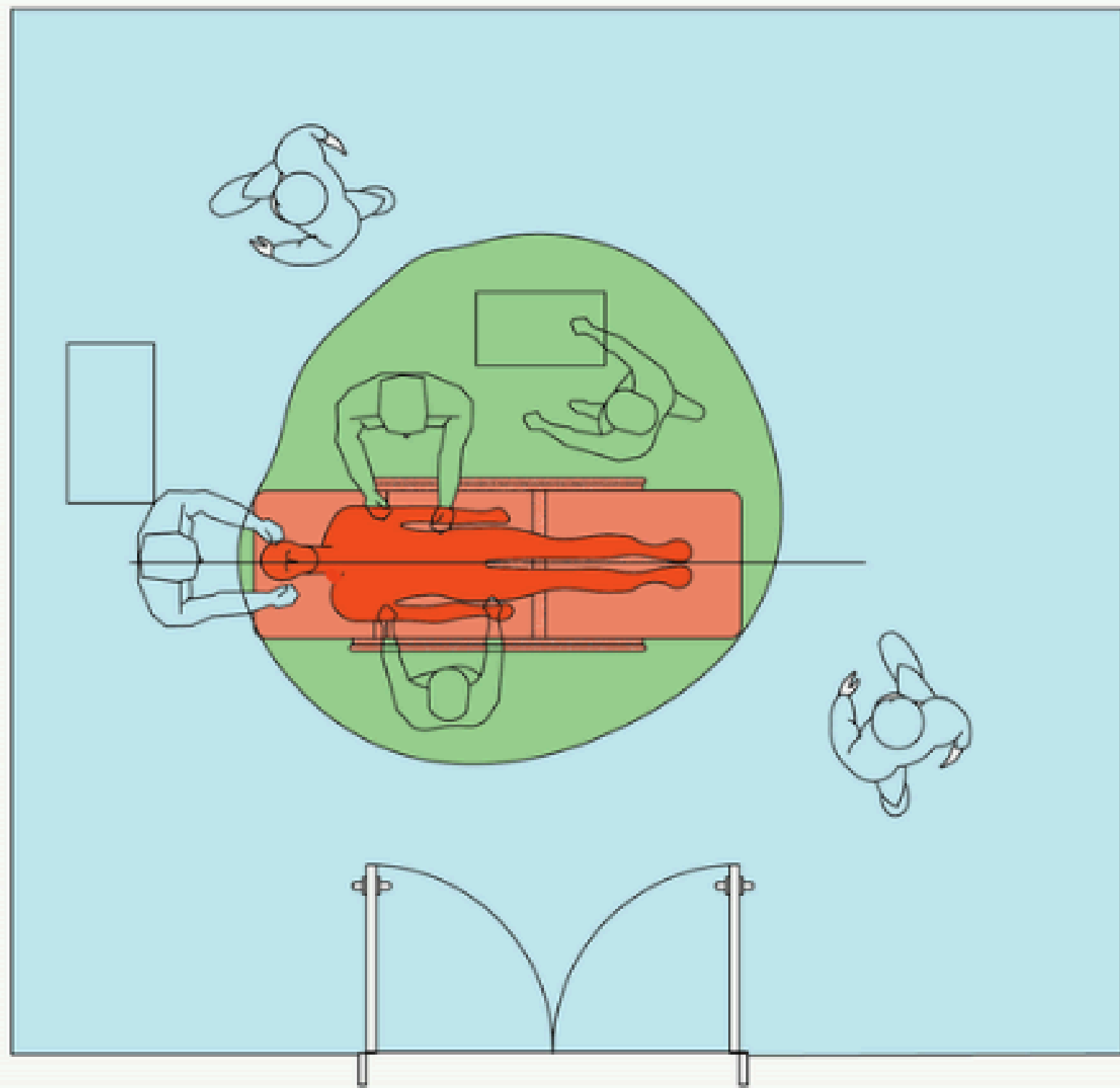


Hand hygiene and Surgical attire

- 1. Staff's hand preparation includes the removal of hand jewelry and artificial nails.**
- 2. Staff's hand preparation should be done by antiseptic solutions using either scrubbing or rubbing before donning gloves.**
- 3. Double gloving with powder-free gloves is recommended.**
- 4. Either disposable non-woven or reusable woven drapes and surgical gowns can be used.**
- 5. Wearing theater attire out of an operation room is discouraged.**

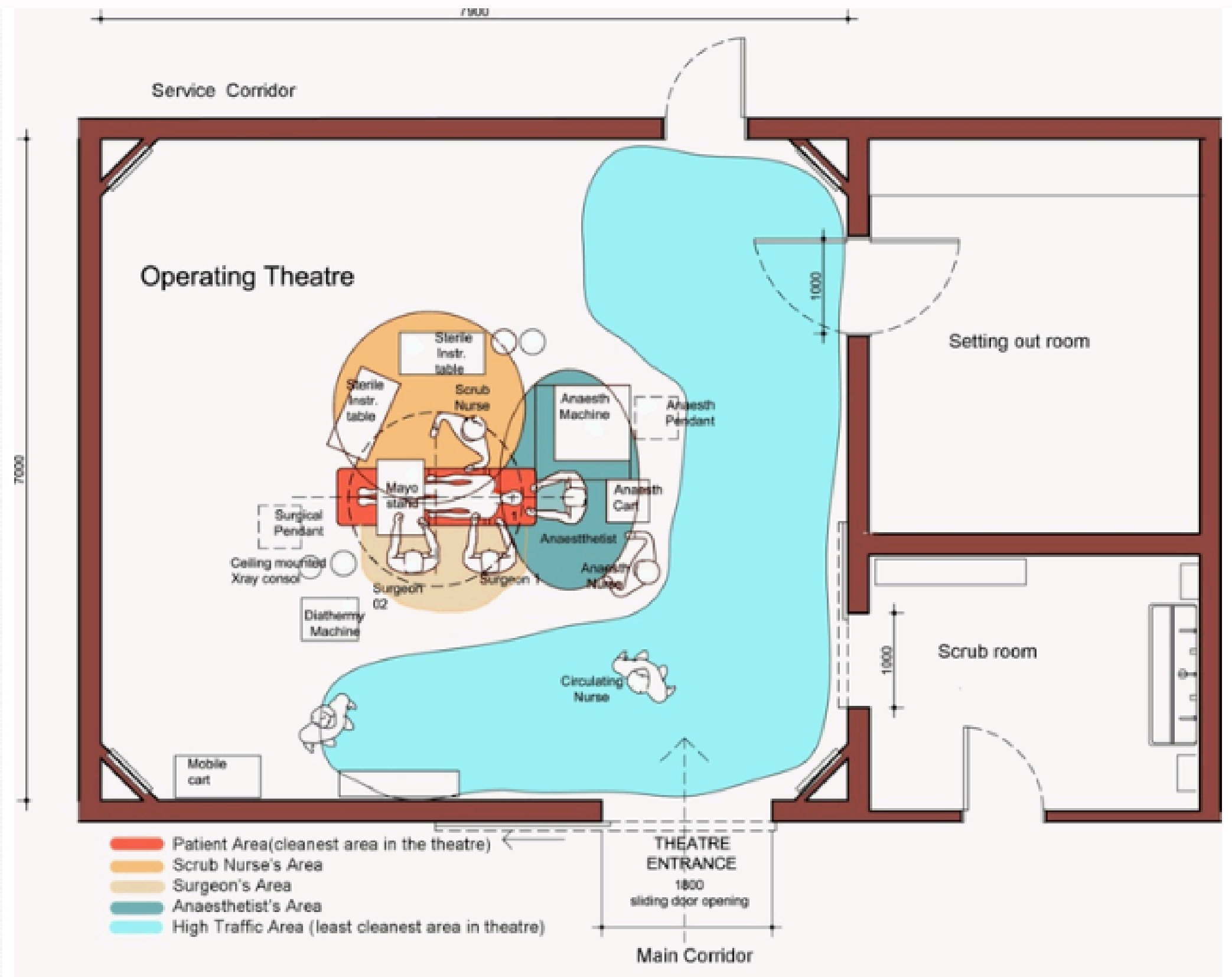
Aseptic technique practices

1. **barriers**: sterile gloves, sterile gowns, sterile drapes, protective wrappers on sterilized instruments
2. **patient and equipment preparation**
3. **environmental controls**: keeping doors closed, minimizing movement in and out of the aseptic field, limiting entry to necessary personnel only, permitting only one patient per aseptic field
4. **contact guidelines** : prohibit any contact between sterile and nonsterile items.

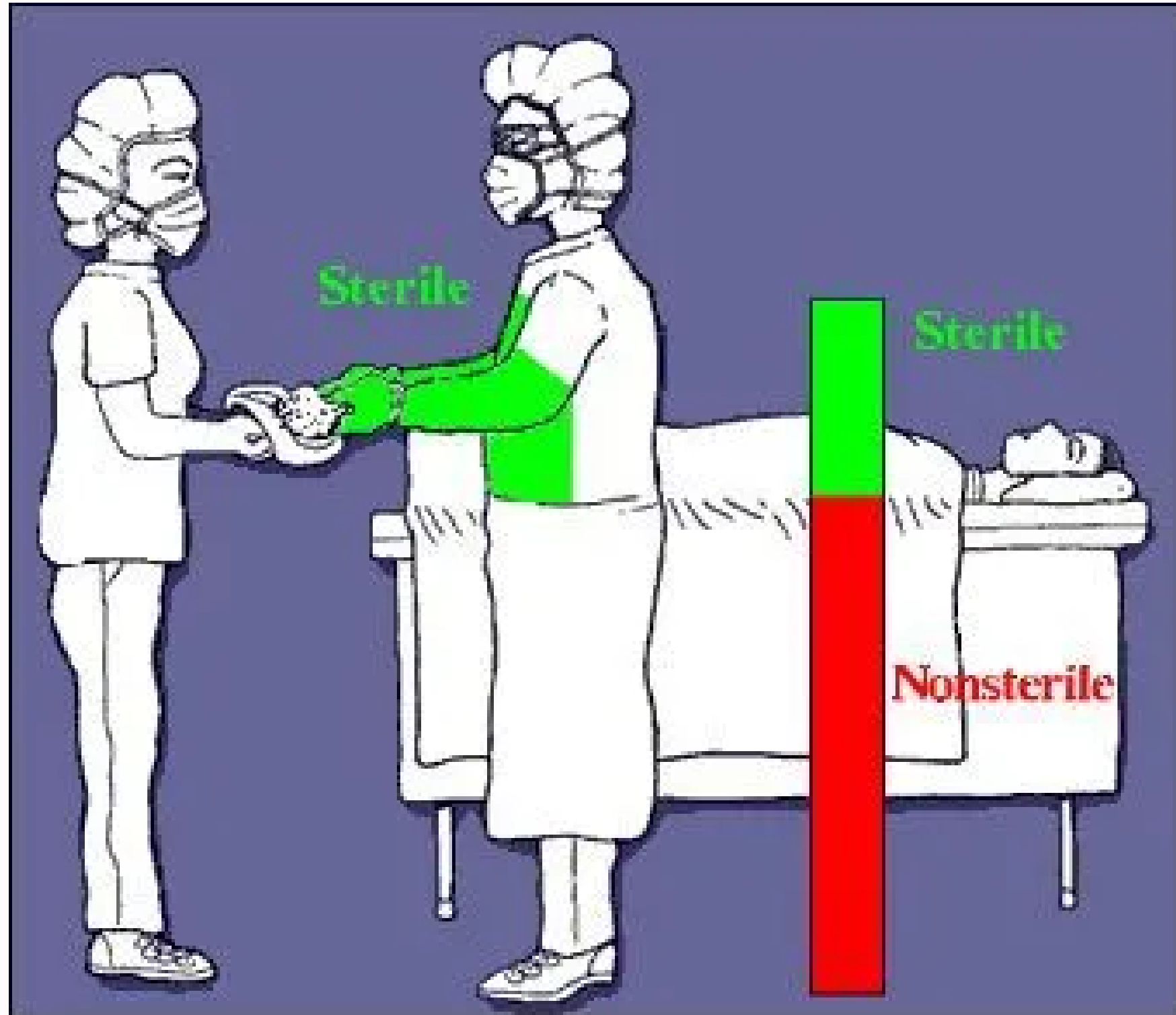


- CORE - PATIENT
- STERILE CIRCLE
- UNSTERILE AREA

Working areas within the operating theatre



Zones within the operating theatre



And if you're unsure, then you better not touch!

Sterile area is the space that includes the patient, the **sterile surgical team**, the table with sterile equipment, and all other sterile-covered equipment.

non-sterile members must not stand above the surgical field

The sterile members (those who have done the surgical washing and performed the dressing and gloving correctly)

Common Breaks in Sterile Technique: Clinical Perspectives and Perioperative Implications

3.4 ©

WILLIAM R. HOPPER, MD, FAAOS; ROSE MOSS, RN, MN, CNOR

Sterilization: proper packaging, correct processing, package container integrity, and proper sterilization indicator

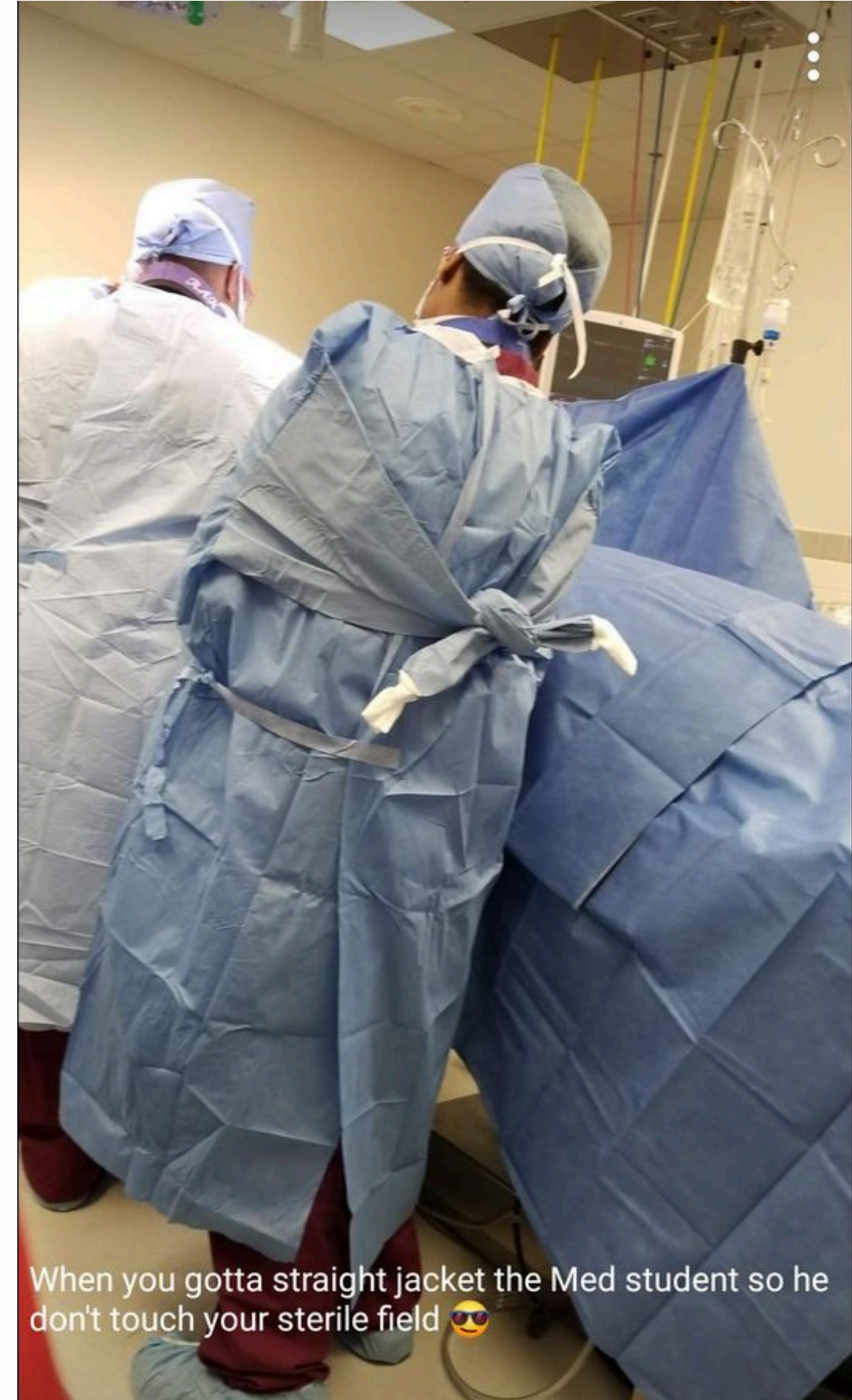
Improperly delivering solutions

Improperly moving tables

Leaving sterile supplies open too long.

Surgical Hand Antisepsis : 3-5min., removing artificial nail, ring watch, cleaning the subungual areas of both hands under running water, donning a mask before scrubbing

Gowning, gloving, draping etc.



When you gotta straight jacket the Med student so he don't touch your sterile field 🤓

Cleaned and safe perioperative environment

01

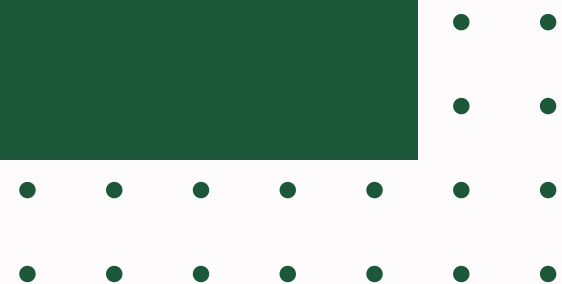
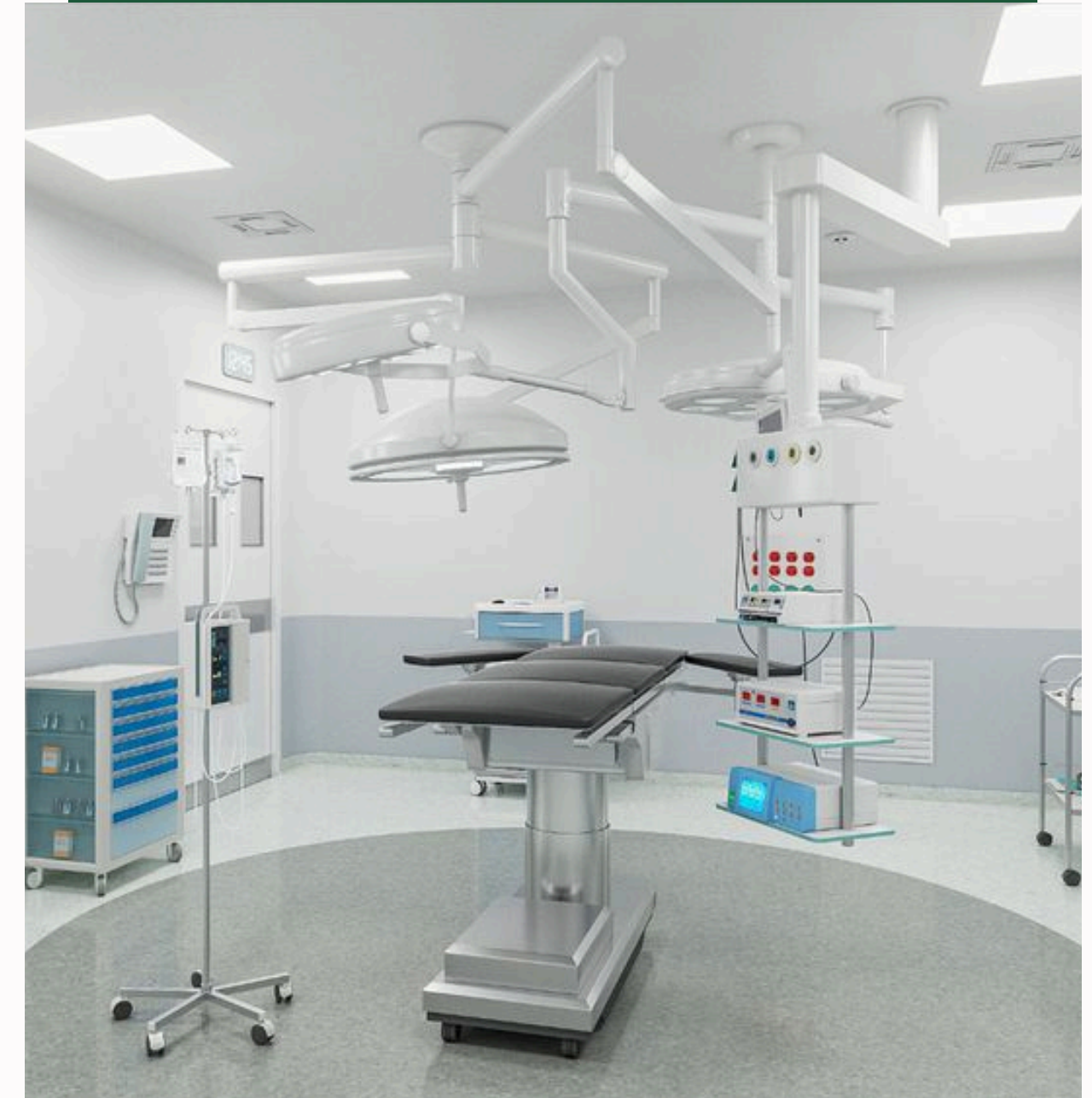
surface

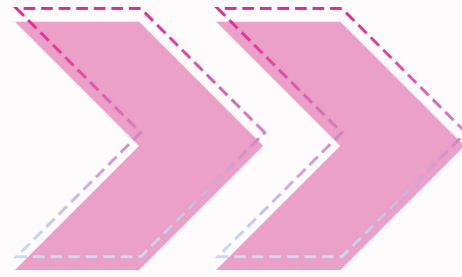
02

ventilation

03

Thermal





การจัดการ OR อย่างไร เพื่อให้
เป็นสถานที่สะอาดปลอดภัยอยู่เสมอ

The operating theater is a highly sterile, aseptic, and restricted area in a hospital setting



Plastic cover of medical charts are frequently contaminated with pathogens and may serve as a source of infection

24 % of HCWs' hands contaminated with *C. difficile* spores after routine care of CDI patient. 44 % of the HCWs with contaminated hands provided at least one episode of direct patient care without the use of gloves

79 % of sampled surfaces were positive for MDROs. Molecular typing identified related strains from patients, the environment and hands of healthcare workers

14 % of clinical and emergency department rooms had ≥ 1 surface contaminated with *C. difficile*. Outpatient clinics may be an important source of community-associated *Clostridium difficile* infection (CDI)

15 % of iPads sampled were positive for *S. aureus*

3 % and 6 % of hospital surfaces were contaminated with MRSA or *C. difficile*, respectively

The persistence of potentially pathogenic staphylococci on hospital surfaces represents an infection threat

Unrecognised colonisation and/or the aerosolisation of enterococci together with inadequate cleaning can lead to widespread persistence in environmental contamination

Environmental contamination due to *C. difficile* aerosolisation can occur when a lidless toilet is flushed

A prior room occupant with CDI is a significant risk factor for CDI acquisition.

Of the patients who acquired CDI after admission, 11 % had a prior occupant with CDI
60 % of surfaces (gowns, bed rail/cranks, table and infusion pumps) in close proximity to patient were positive for MRSA and may serve as reservoirs for infection

Bacterial contamination of stethoscopes ranges between 66–90 %, depending on the site sampled (bells, earpieces and diaphragms). The presence of pathogenic and non-pathogenic bacteria on stethoscopes may pose a potential transmission risk

Toxin-producing *C. difficile* present in non-isolation rooms (16 %), physician work areas (31 %), nurses work station (10 %) and portable equipment (21 %)

Acquisition of VRE from prior environmental contamination of the ICU

Coagulase-negative staphylococci, MRSA, *E. coli*, *K. pneumoniae* and *A. baumannii*
C. difficile

MRSA, VRE, *E. coli* and *K. pneumoniae* resistant to extended-spectrum cephalosporins, and carbapenem-resistant (CR) *A. baumannii*
C. difficile

S. aureus

MRSA, *C. difficile*

Staphylococci spp.

Enterococci spp.

C. difficile

C. difficile

MRSA

Micrococcus spp., coagulase-negative staph, MRSA, MSSA, *Pseudomonas* spp., *Enterobacter* spp., *E. coli*, *Streptococcus* viridans group

C. difficile

VRE

Evidence of persistence of microorganisms on surfaces and/or acquisition of infection from contaminated environment

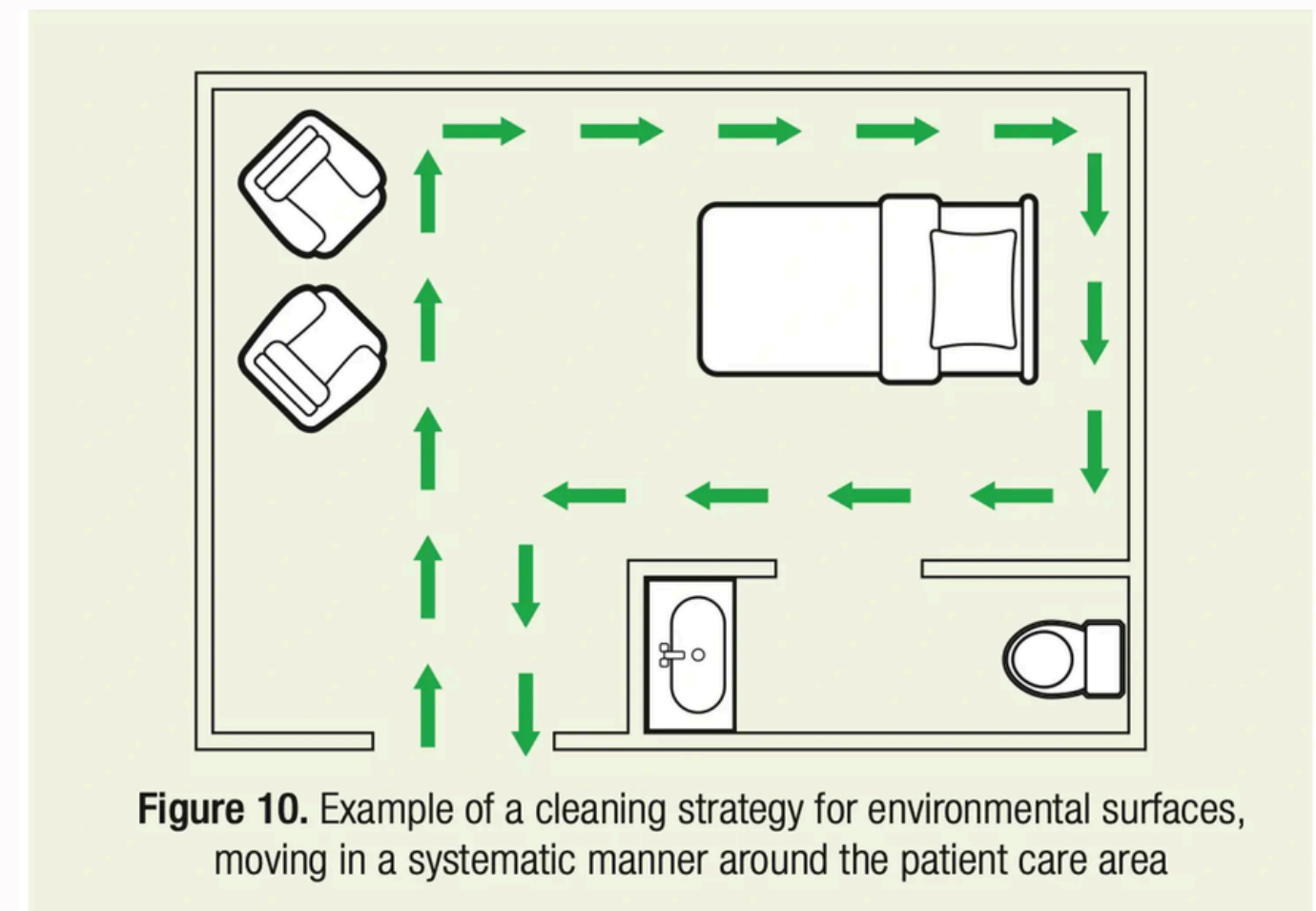
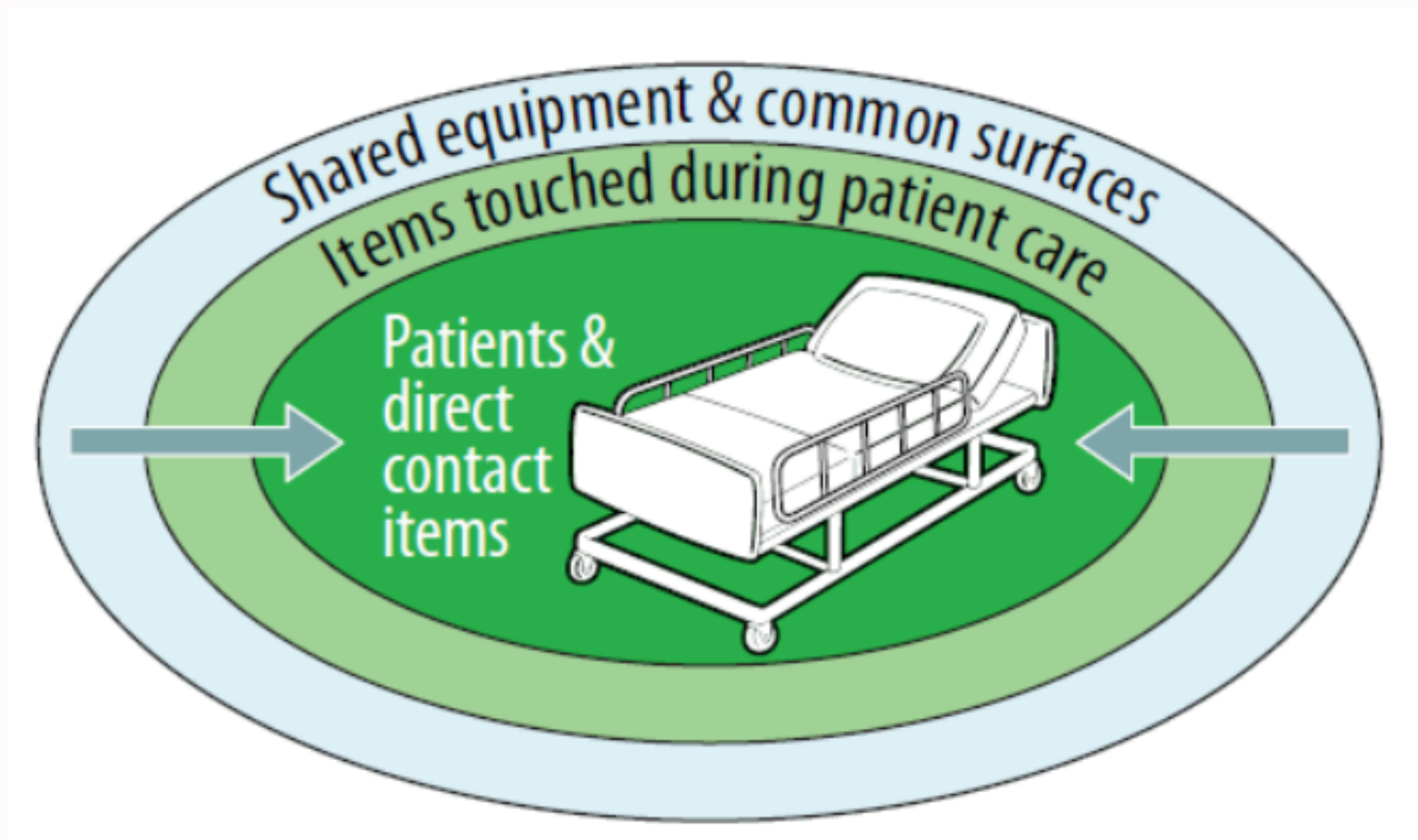
Persistence of microorganisms on dry surfaces

Organism	Persistence (range)
<i>Acinetobacter</i> spp.	3 days to 5 months
<i>Clostridium difficile</i> (spores)	5 months
<i>Enterococcus</i> spp. including vancomycin-resistant enterococci	5 days to 4 months
<i>Escherichia coli</i>	1.5 h to 16 months
<i>Klebsiella</i> spp.	2 h to >30 months
<i>Mycobacterium tuberculosis</i>	1 day to 4 months
<i>Pseudomonas aeruginosa</i>	6 h to 16 months
<i>Salmonella typhimurium</i>	10 days to 4.2 years
<i>Shigella</i> spp.	2 days to 5 months
<i>Staphylococcus aureus</i> , including MRSA	7 days to 7 months
<i>Haemophilus influenzae</i>	12 days
Adenovirus	7 days to 3 months
Influenza virus	1–2 days
Norovirus and feline calicivirus (FCV)	8 h to 7 days



Surface

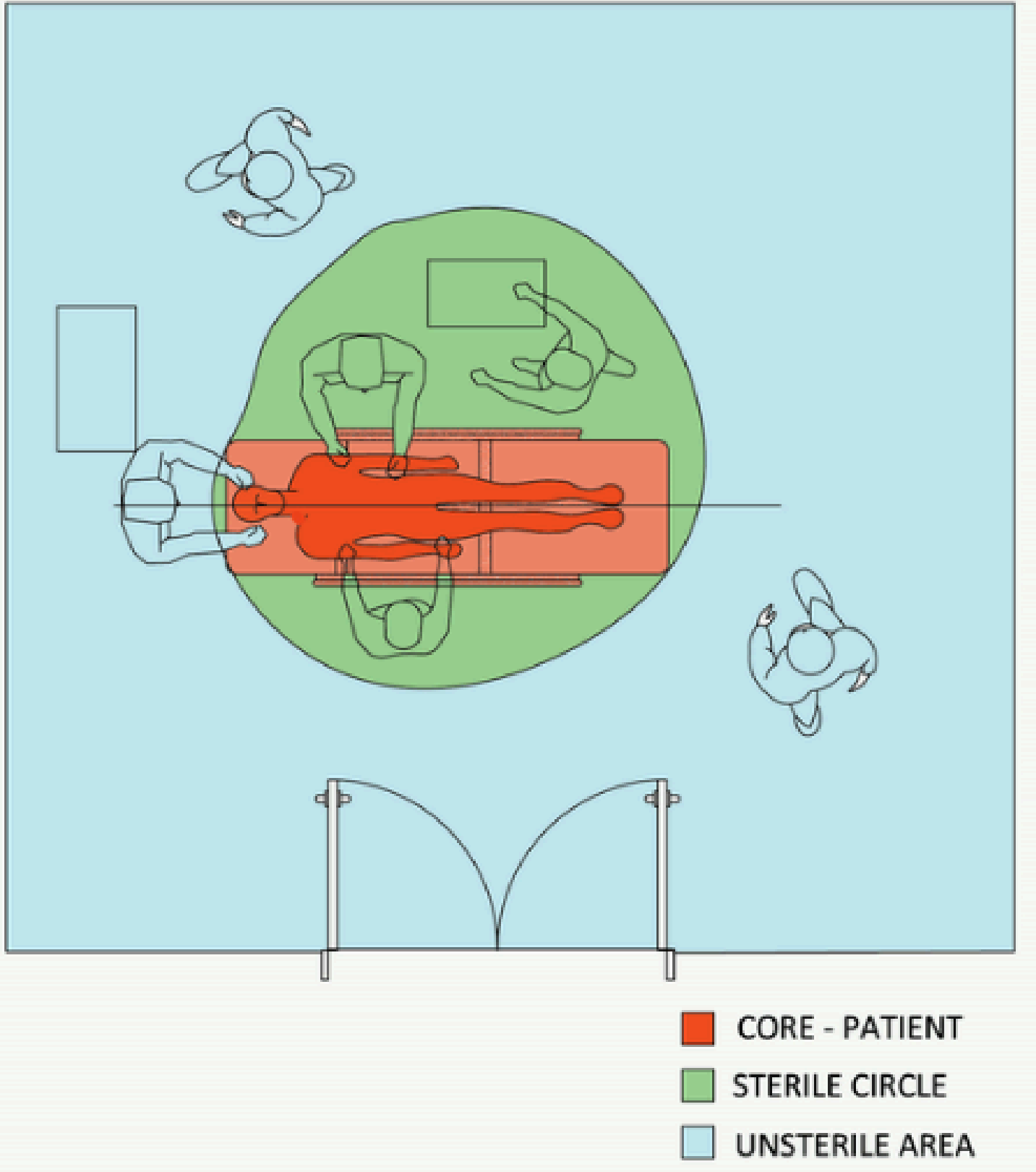
หลักการทำความสะอาด คือ
ทำความสะอาดจากที่สะอาด -> ที่สกปรก , บน-> ล่าง,
ใน -> นอกและ ทำให้เป็นแบบแผน
เพื่อให้ได้รับการทำความสะอาดทุกพื้นที่



Which areas have been cleaned?

- 01 all areas must be cleaned
- 02 cleaning operating room first and toilet should be cleaned last.
- 03 all equipments must be cleaned

ภายในห้องผ่าตัดทำอย่างไร

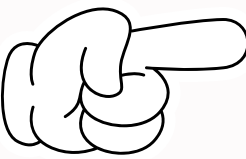


visible soil cleaned first

direction



- ไม่ใช้ผ้าแห้ง
- ผ้าใช้เช็ดแล้ว ไม่ใช้ซักในถังน้ำซ้ำ
- กรณีผสมน้ำยาฆ่าเชื้อ ต้องระวังเรื่องมาตรฐาน



ทุกอุปกรณ์ที่มีใน OR และ ทุกพื้นที่ใน OR ต้องมีตารางการทำความสะอาด

When is cleaning happened

01

Every day, before
surgery begins

Between patients

02

03

After the last
operation of the day

Deeper cleans are carried
out once a week and/or
once a month

04

How

01 Before the first procedure

If there was no written confirmation or terminal cleaning on the previous day, do a full terminal clean.

02 Before and after each procedure

- Remove all used linen and surgical drapes, waste, and kick buckets.
- Clean all surfaces (high- and low-touch) and the floor inside of the surgical field

03 Terminal cleaning

- Clean all surfaces, all equipment in operation room, all portable equipment used with patient
- Horizontal and vertical surface, handwashing sink



Recommended Frequency and Process for Operating Rooms

Frequency	Process
<p>Before the first procedure</p>	<p>Carefully inspect records and assess the operating space to ensure that the terminal clean was completed the previous evening.</p> <p>Wipe all horizontal surfaces in the room (e.g., furniture, surgical lights, operating bed, stationary equipment) with a disinfectant to remove any dust accumulated overnight.</p> <ul style="list-style-type: none"> Under normal circumstances, it is not necessary to perform the cleaning step in the morning if terminal cleaning was conducted the evening before. This preliminary clean just utilizes a disinfectant to ensure that the space is fully decontaminated before the first procedure. <p>If there was no written confirmation or terminal cleaning on the previous day, do a full terminal clean (see After the final procedure (i.e., terminal clean) on this table).</p> <p>Thoroughly clean and disinfect portable patient-care equipment that is not stored within the operating room, such as suction regulators, anesthesia trolley, compressed gas tanks, x-ray machines, and lead gowns, before introduction into the operating room.</p>

Who does check? & How do they check?

Frequency

Process

Before and after each procedure

Remove all used linen and surgical drapes, waste (including used suction canisters, $\frac{3}{4}$ filled sharps containers), and kick buckets, for reprocessing or disposal.

Clean and disinfect:

- high-touch surfaces (e.g., light switches, doorknobs) outside of the surgical field
- any visible blood or body fluids outside of the surgical field (e.g., walls, floors)
- all surfaces (high- and low-touch) and the floor inside of the surgical field, including:
 - ▶ tops of surgical lights
 - ▶ reflective portion of surgical lights
 - ▶ suction canisters
 - ▶ tourniquet cuffs and leads
 - ▶ anesthesia trolley
 - ▶ operating table from top to bottom

**Have we cleaned completely?
Does it safe for next operation?**

After the final procedure (i.e., terminal clean)

Clean and disinfect:

- horizontal surfaces (high- and low-touch) and fixed equipment in the room, including booms and wheels of any equipment (e.g., carts)
- vertical surfaces such as walls and windows as needed to remove visible soiling
- ventilation (ducts)
- handwashing sinks, scrub and utility areas/sinks
- entire floor, including baseboards
 - take care to move the operating table and any mobile equipment to make sure to reach the floor areas underneath

Thoroughly clean and disinfect portable patient-care equipment that is not stored within the operating room before removal from the operating room. Examples include:

- suction regulators
- anesthesia trolley
- compressed gas tanks
- x-ray machines
- lead gowns

Terminal cleaning

Scheduled basis
(e.g., weekly)

At the same time as daily terminal cleaning, clean and disinfect:

- low-touch surfaces not cleaned every day (unless visibly soiled), including:
 - ▶ ceilings
 - ▶ walls
 - ▶ insides of cupboards

What we have done?

Environmental Cleaning Supplies and Equipment for the Operating Room (OR):

Have dedicated supplies and equipment for the OR (e.g., mops, buckets).

Use fresh mops/floor cloths and mopping solutions for every cleaning session, including between procedures.

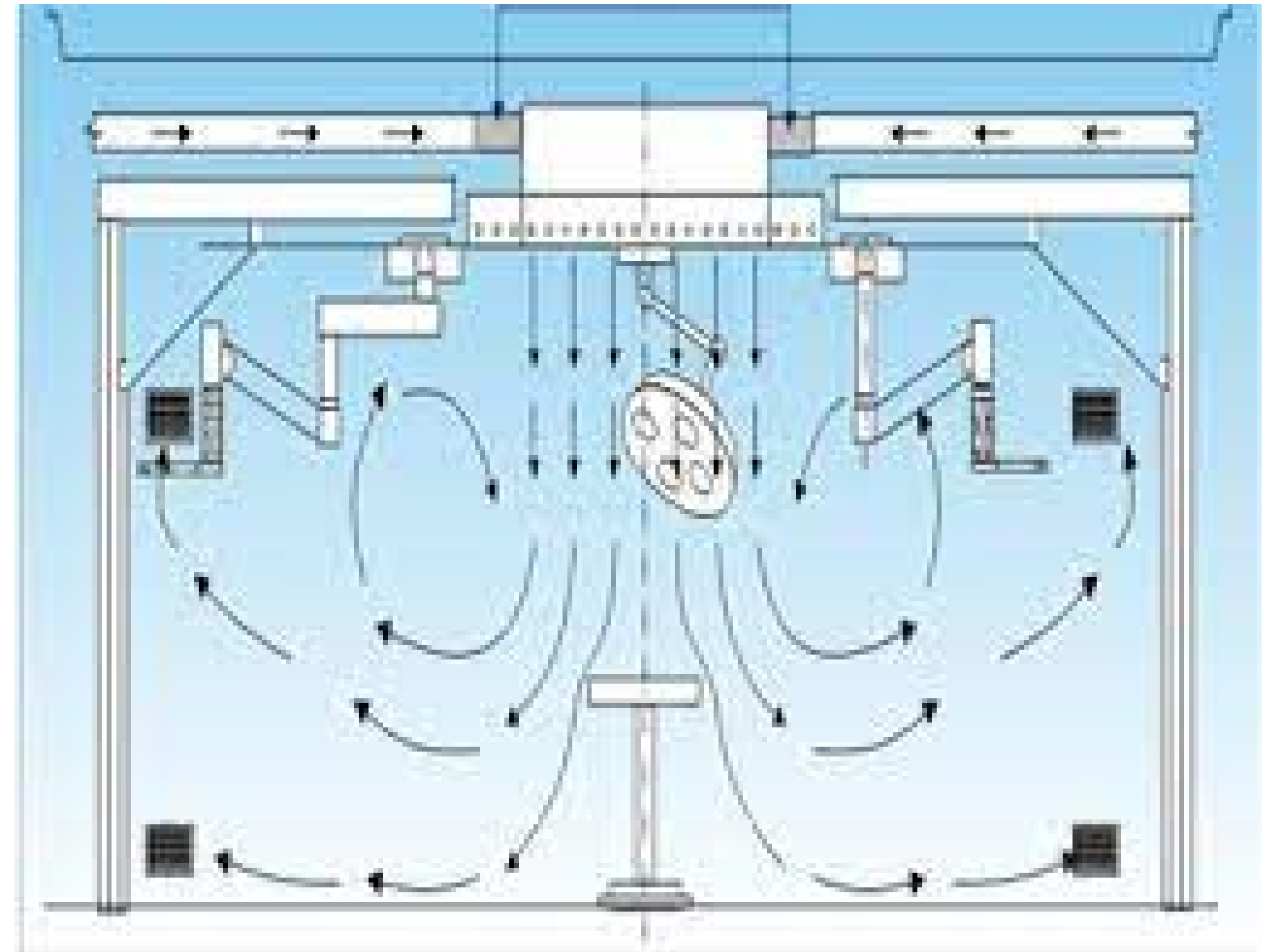
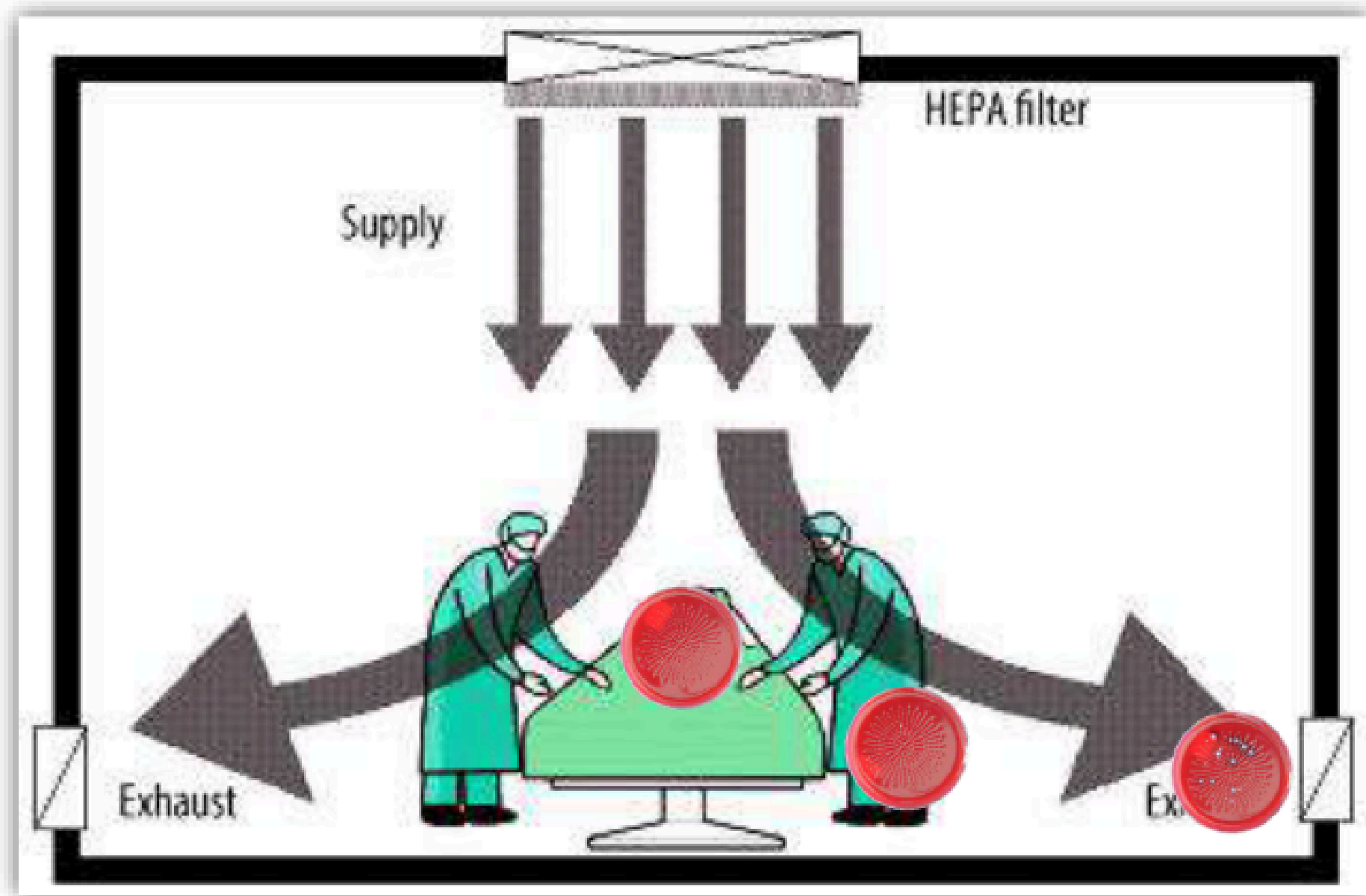
Use fresh cleaning cloths for every cleaning session, regularly replacing them during cleaning and never double-dipping them into cleaning and disinfectant solutions.



**Good ventilation
can prevent SSI
and save staffs**



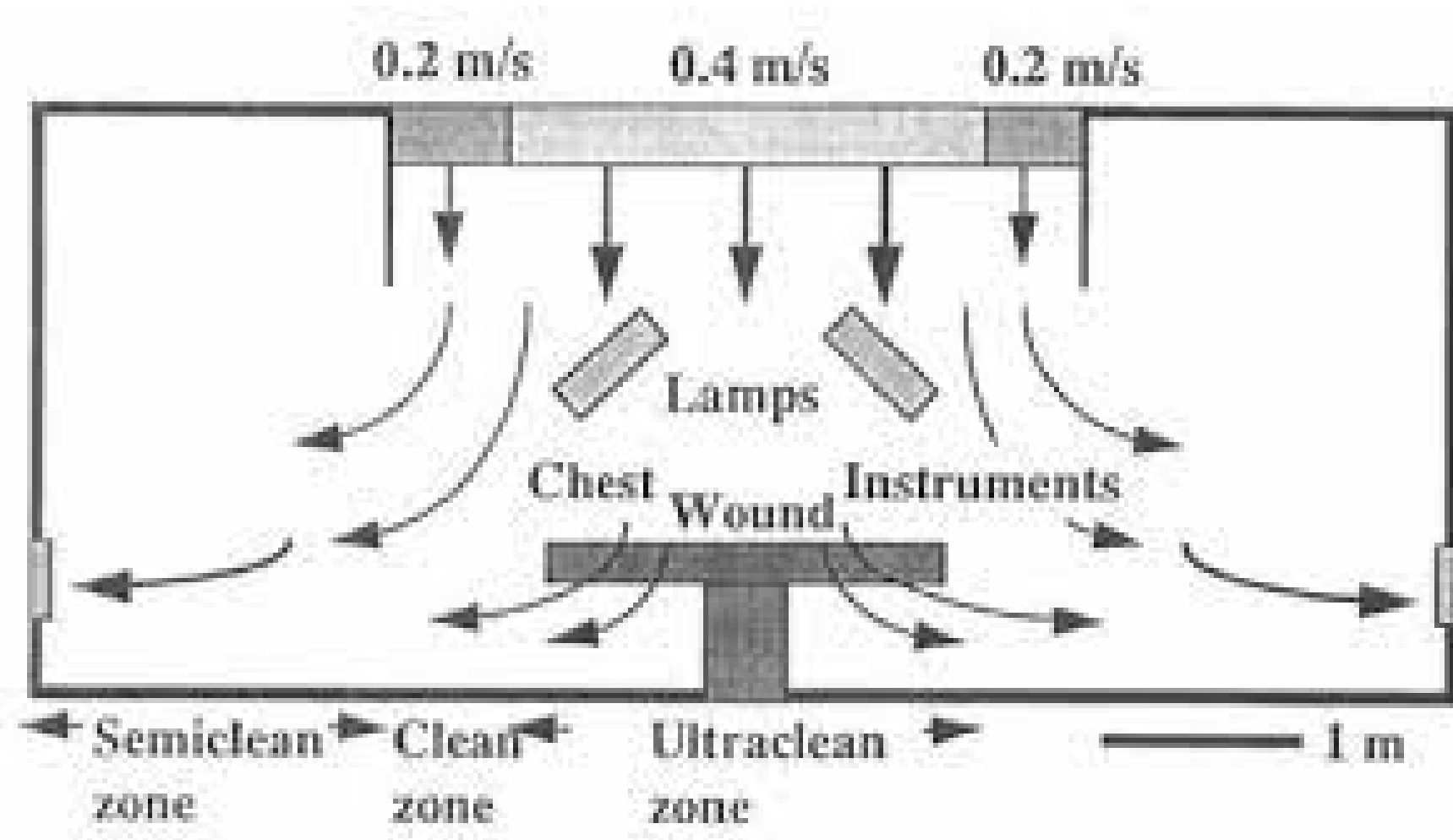
Laminar airflow direction and positioning of teams



Increase in SSI rate can be attributed to the positioning of the operating team (without personal isolation suits) between the patient and the airflow unit

เครดิตข้อมูล อ.สุวัฒน์ สุขสวัสดิ์

good ventilation ?



or blockage ?



Air Changes per hour (ACH) and time in minutes required for removal efficiencies of 90, 99 and 99.9% of airborne contaminants

ACH	Minutes required for a removal efficiency of:		
	90%	99%	99.9%
1	138	276	414
2	69	138	207
4	35	69	104
6	23	46	69
8	17	35	52
10	14	28	41
12	12	23	35
14	10	20	30
16	9	17	26
18	8	15	23
20	7	14	21
30			14
40			10
50			8

OR →

Door had been closed all time

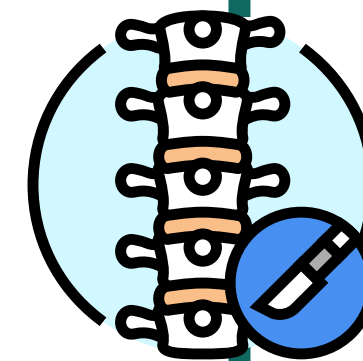
Thermal comfort and hypothermia



Staffs comfort



**patients comfort
and prevented
hypothermia**



**Thermal sensitive
equipments**

OR temperature suggested by different standards.

UNI 11425:2011 [107] (Italy)	Winter ≥ 20 °C, $\geq 40\%$ RH Summer ≤ 24 °C, $\leq 60\%$ R
NF S 90 351 [108] (France and Belgium)	19–26 °C, 45–65% RH
ASHRAE, Std 170, 9/05 [5] (USA)	17–27 °C adjustable, 45–55% RH
DIN 1946-4 [7] (Germany)	19–26 °C adjustable, RH as per DIN 13779
SWKI 99-3F [109] (Switzerland)	18–24 °C adjustable, 30–50% RH
GB 50333-2013 [110] (China)	Level I clean OR temperatures 21–25 °C
GOST R 52 539/2006 [111] (Russia)	18–24 °C ± 1 °C, min value 30% RH with 22 °C

Outbreak investigation

- **Detection**
- **review patient factor**
- **review SSI bundle** (esp. clipping hair, ATB prophylaxis, Blood sugar and other site infection)
- **review process and compliance in OR**
- **review cleaning process**
- **review instrument / environment in OR & CSSD**
- **review quality of ventilation / water / storage of antiseptic**

Investigation of an outbreak of device-related postoperative ventriculitis: A lesson learnt

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Figure 1: Ultrasonic aspirator

Sterilized instruments used for surgery, including the ultrasonic aspirator (USA) sets and other hollow devices, were randomly sampled and cultured

Following the above episode, the practice of formaldehyde sterilization of the surgical aspirators was changed to ethylene oxide (ETO) sterilization.

**Post neurosurgery infection 5 รายจาก
P.aeruginosa**

Table 3 Univariate factors analyzed for PCNSI after cranial operations

Factor	(+)PCNSI, <i>n</i> (%)	(-)PCNSI, <i>n</i> (%)	OR (95 % CI)	<i>p</i> -Value
Age < median age (54 y)	64 (8.9)	659 (91.1)	1.515 (1.020–2.251)	0.039
Male sex	56 (6.9)	752 (93.1)	0.856 (0.579–1.264)	0.434
Pre-operative stay, mean ± SD (d)	6.12±5.288	5.59 (6.530)	1.011 (0.985–1.038)	0.412
Pre-operative stay >7 d	36 (10.2)	317 (89.8)	1.624 (1.069–2.468)	0.022
Recent hospitalization history	22 (8.3)	244 (91.7)	1.158 (0.711–1.885)	0.556
GCS score	13.29±3.250	13.73±2.877	0.956 (0.900–1.014)	0.133
GCS score <9	15 (10.3)	130 (89.7)	1.511 (0.851–2.683)	0.156
ASA score ≥2	48 (8.5)	520 (91.5)	1.273 (0.859–1.887)	0.229
Pre-operative tracheotomy	1 (9.1)	10 (90.9)	1.251 (0.159–9.863)	0.573
Operation type				
Cranioplasty	6 (3.5)	166 (96.5)	1 (reference)	
Aneurysm	8 (6.0)	126 (94.0)	1.757 (0.594–5.191)	0.308
AVM	5 (22.7)	17 (77.3)	8.137 (2.246–29.487)	0.001
Tumor resection	62 (10.0)	558 (90)	3.047 (1.306–7.233)	0.010
Hematoma removal	13 (3.6)	345 (96.4)	1.043 (0.389–2.791)	0.934
Decompressive craniotomy	0 (0)	5 (100)	0	–
Microvascular decompression	3 (10.3)	26 (89.7)	3.192 (0.75–13.558)	0.116
External CSF drainage	6 (15.4)	33 (84.6)	5.030 (1.526–16.562)	0.008
VP shunt	6 (6.6)	85 (93.4)	1.953 (0.611–6.238)	0.259
CSF drainage of any kind	19 (11.3)	149 (88.7)	1.717 (1.018–2.898)	0.041
Emergency operation	31 (8.2)	347 (91.8)	1.161 (0.753–1.792)	0.499
Surgical site classification ≥2	15 (8.2)	168 (91.8)	1.133 (0.642–2.000)	0.666
Surgery duration (h)	4.95±2.749	3.3±2.040	1.312 (1.219–1.412)	<0.001
Subgaleal drainage	79 (8.7)	831 (91.3)	1.680 (1.088–2.593)	0.018
Permanent device implantation	70 (7.6)	857 (92.4)	1.056 (0.703–1.585)	0.808
Subsequent operations	18 (17.6)	84 (82.4)	3.007 (1.732–5.221)	<0.001
CSF leakage	23 (22.1)	81 (77.9)	4.226 (2.533–7.052)	<0.001

y, years; d, days; h, hours; GCS, Glasgow Coma Scale; ASA, American Society of Anesthesiologists; AVM, arteriovenous malformation; CSF, cerebrospinal fluid; SD, standard deviation; VP, ventriculoperitoneal; OR, odds ratio; CI, confidence interval

Table 4 Final logistic regression model of the risk factors for PCNSI after cranial operations

Factor	OR (95 % CI)	<i>p</i> -Value
CSF leakage	3.545 (2.053–6.122)	<0.001
CSF drainage of any kind	2.858 (1.577–5.181)	0.001
Subsequent operations	2.224 (1.229–4.024)	0.008
Surgery duration	1.331 (1.230–1.440)	<0.001

CSF, cerebrospinal fluid; OR, odds ratio; CI, confidence interval

Impact of Operating Room Environment on Postoperative Central Nervous System Infection in a Resource-Limited Neurosurgical Center in South Asia

Swathi Chidambaram¹, Madabushi Chakravarthy Vasudevan², Mani Nathan Nair³, Cara Joyce⁴, Anand V. Germanwala¹

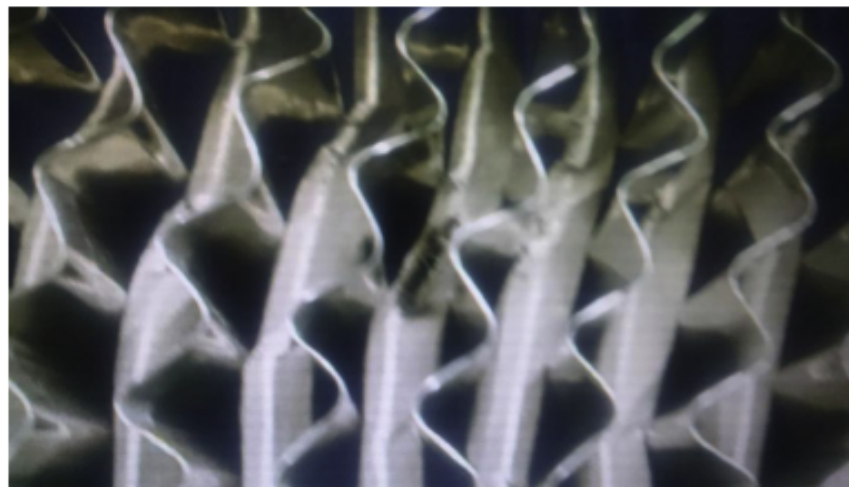


Figure 2. Damage to the filtration media.



Figure 1. Gaps between the 4 quadrants of the screen.

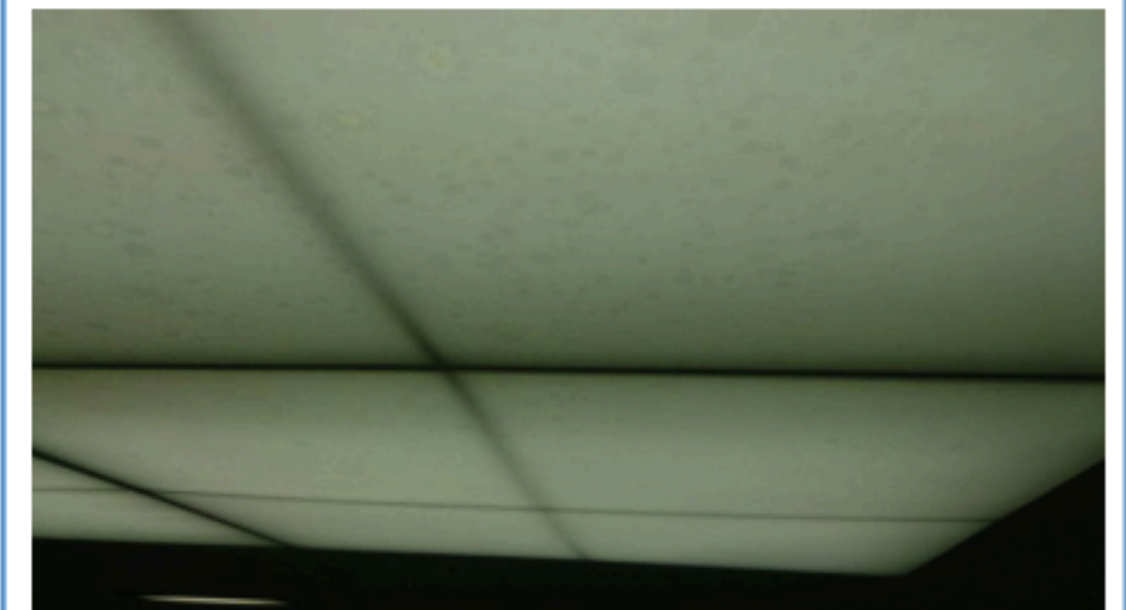


Figure 3. Microbiological growth is seen on the screen.

before and after routine servicing of the OR filtration system that incidentally identified serious structural errors in its design that likely contributed to the high rate of PCNSIs initially

Multimodal environmental cleaning strategies to prevent healthcare-associated infections



Katrina Browne^{1,2} and Brett G Mitchell^{1,2,3,4*}

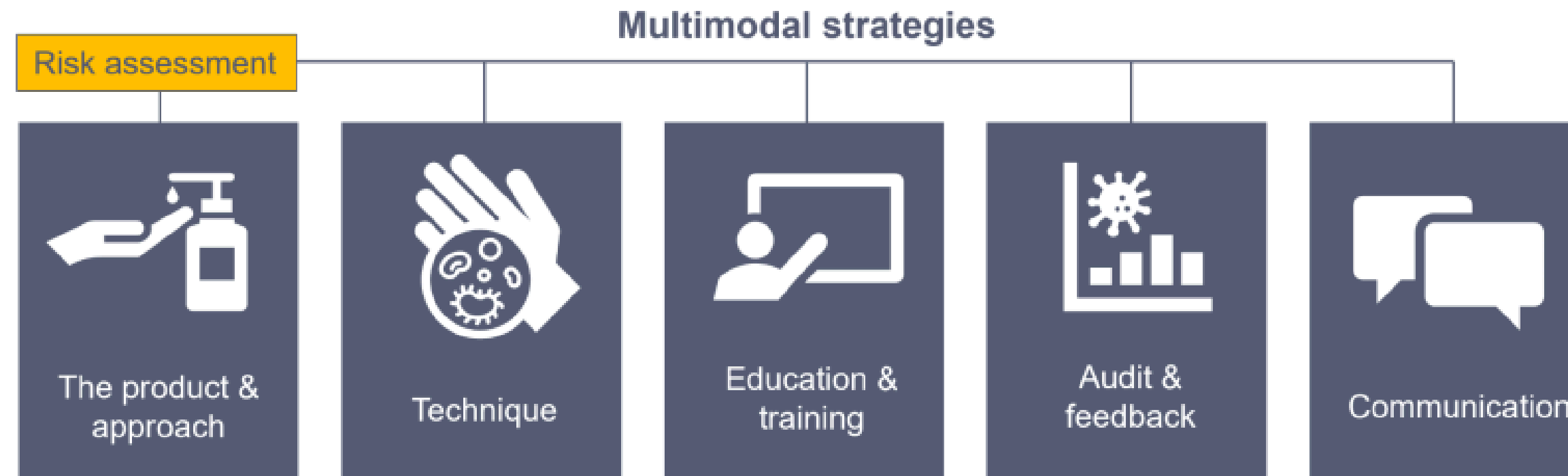
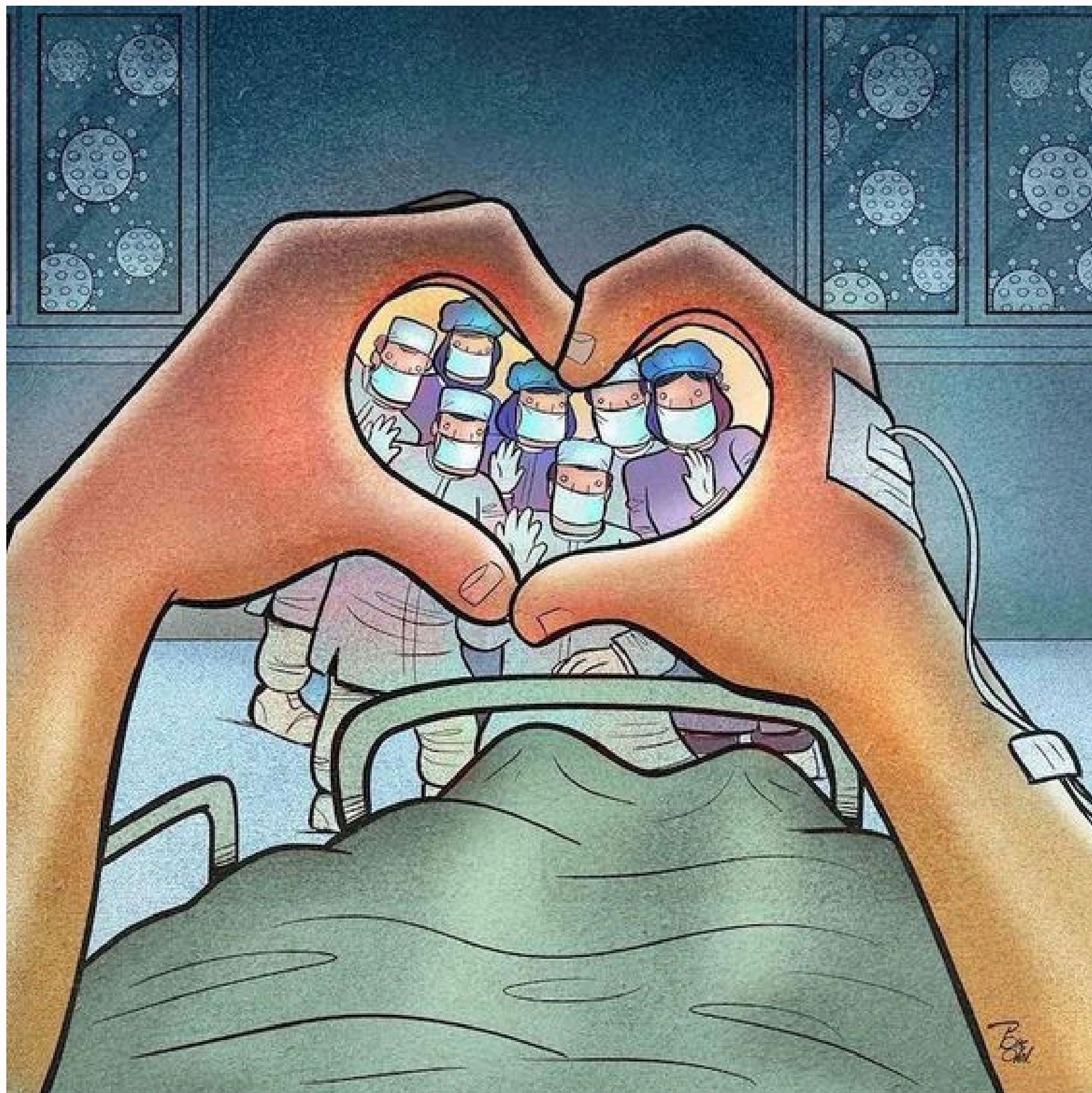


Fig. 1 A multimodal approach to environmental cleaning in healthcare facilities encompasses five key strategies: the product and approach used for cleaning, technique, education and training, audit and feedback, and communication (adapted from REACH study [7]).

design and implement a multimodal intervention



**THANK YOU
FOR YOUR HARD
WORKING**